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CONTACT TRANSFORMATIONS LINEAR IN x, y, z; APPLICATIONS TO EQUILONG TRANSFORMATIONS.

By B. H. Brown.

We consider transformations of the form

$$
\begin{aligned}
X &= a_{11}x + a_{12}y + a_{13}z + \lambda,\\
Y &= a_{21}x + a_{22}y + a_{23}z + \mu,\\
Z &= a_{31}x + a_{32}y + a_{33}z + \nu,\\
P &= -\frac{pA_{11} + qA_{12} - A_{13}}{pA_{31} + qA_{32} - A_{33}},\\
Q &= -\frac{pA_{21} + qA_{22} - A_{23}}{pA_{31} + qA_{32} - A_{33}};
\end{aligned}
\tag{1}
$$

where:

(*a*) a_{ij}, λ, μ, ν are functions of p and q;

(*b*) A_{ij} represents the cofactor of a_{ij};

(*c*) $|a_{ij}| \not\equiv 0$, hence $J \not\equiv 0$;

(*d*) no one of the three expressions $pA_{i1} + qA_{i2} - A_{i3}$ vanishes.

Every such transformation carries any aggregate of ∞^2 planar elements with the same plane into a similar aggregate; but this is not necessarily a plane transformation. A transformation which carries planes into planes carries the point of intersection of three infinitely near planes into the point of intersection of the transformed planes; that is, a plane transformation is necessarily a contact transformation. Not all plane transformations are of type (1), but all contact transformations of type (1) are plane transformations.

For a contact transformation it is necessary and sufficient that

$$
dZ - PdX - QdY \equiv \varrho\,(dz - p\,dx - q\,dy);
\tag{2}
$$

where $\varrho(x, y, z, p, q) \not\equiv 0$. Expanding (2) we have

$$
\begin{aligned}
Z - PX_x - QY_x &\equiv -p\varrho,\\
Z - PX_y - QY_y &\equiv -q\varrho,\\
Z - PX_z - QY_z &\equiv \varrho,\\
Z - PX_p - QY_p &\equiv 0,\\
Z - PX_q - QY_q &\equiv 0.
\end{aligned}
\tag{3}
$$